

# Toxic Pesticide Drift- A Study of 20 Cases

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**Abstract:** *This study of 20 cases of accidental organophosphates poisoning while spraying pesticide, is an observational study of consecutive such cases that were admitted under General Medicine units of our tertiary care Government hospital over 5 months. 95% patients had a mild to moderate form of illness from which they recovered. One patient however succumbed. The common factors were that (i) none of the patients had worn proper protective gear and (ii) all the patients developed toxic effects of the pesticide spray while spraying B T cotton plants, that were almost as tall as themselves. While spraying the tops of these plants, the spray may have directly drifted on to the face of the farmer due to wind. Airborne movement of a pesticide to unintended targets is called pesticide drift. This can pollute soil, water and crops. The immediate adverse result is, toxic effects on the person who is spraying the pesticide.*

**Keywords-** Pesticide drift, organophosphates, insecticide spraying.

## 1. Introduction

A pesticide is any substance or a mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Pesticides are chemical or biological substances widely used in agricultural production to control pests, disease, weeds etc. They reduce disease and maintain high quality of the product[1].

A wide range of products-insecticides, herbicides, rodenticides, molluscicides, nematocides, even plant growth regulators are included in this category. Organophosphates were introduced in the 1960s and carbamates in the 1970s. In India, the production of pesticides began in 1952 and is now the second highest manufacturer in Asia (after China) and 12<sup>th</sup> globally. 45% of the use is for cotton, followed by paddy and wheat[2].

Natural plant derived or biologically based pesticides like neem oil, pyrethrum daisy, pheromones and microbes are safer [1].

However, organophosphates are probably the commonest pesticides to be used in India and definitely in the state of Maharashtra. Poisoning with these substances is one of the commonest problems that we face in the ICU-It is mostly a suicidal attempt. 76% of pesticides in India are insecticides, as against 44% globally[2]. However, we do see cases of accidental poisoning too...by the oral route, or while spraying in the field.

Mechanism of action of organophosphates-

The enzyme cholinesterase, located at nerve terminals, normally hydrolyses acetylcholine. The organophosphates phosphorylate cholinesterase; hence it cannot hydrolyse acetylcholine, which accumulates at the receptors producing nicotinic

and muscarinic signs. Muscarinic effects like miosis, diarrhoea, vomiting, sweating, bronchial secretions can be countered by atropine (or glycopyrrolate)[4].

Nicotinic signs do not respond to atropine and if neuroparalysis leading to respiratory muscle paralysis occurs, artificial ventilation is the only remedy. Oximes like P2AM displace the organophosphates from acetylcholine esterases and bind to the enzyme. They then dissociate and reactivate cholinesterase. P2AM works best in the first 36-48 hours and best given as bolus doses.

Pesticides should be effective, cost effective and safe for the operator and the environment. The safety factor is often lacking due to the non judicious, excessive or careless use of pesticides.

In the EU-FAO IPM programme for the cotton growers in southern India, the effect of pesticides was studied on farmers with the help of self assessment forms. They were earlier told about the toxic effects of pesticides and assessed after they had been handling pesticides for few weeks. Of the 323 farmers studied in 4 months, 16.4% were asymptomatic, 39% had mild, 38% had moderate and 6% had severe features of poisoning.

## 2. Study-

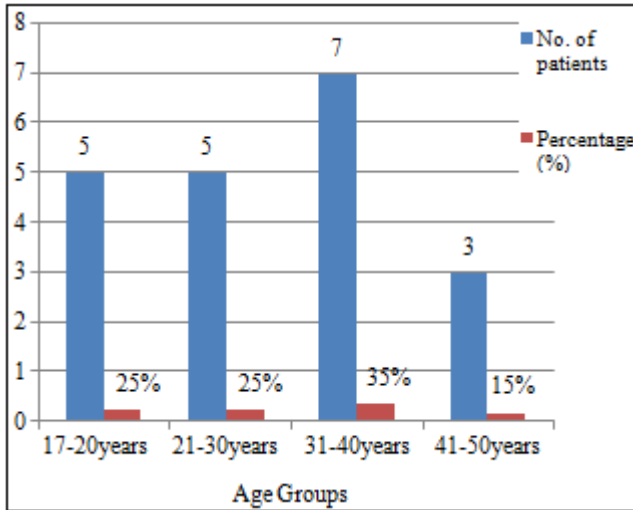
This is an observational study of 20 consecutive cases who were admitted to the Medicine wards during July 2016 to November 2016 (5 months) due to toxic effects of organophosphates while spraying.

All cases were medico-legal, history was recorded in detail, either from the patient or from accompanying persons, about the victim's education, the pump used, protective measures

taken, weather conditions, type of crop and approximate height of plants, especially in relation to the victim's height and this awareness about safety measures. There were no exclusion criteria. All patients/caregivers consented to be part of the study.

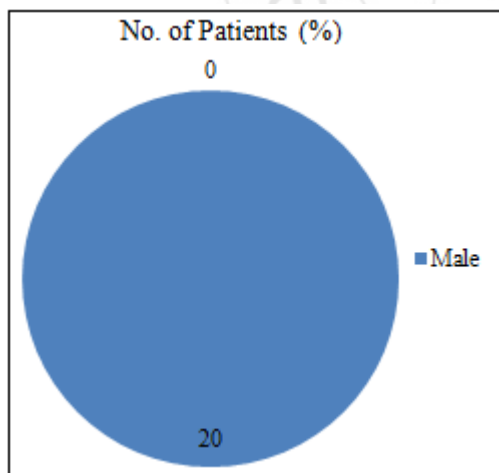
**Table 1: Age of patients**

Age groups	Number of Patients (Percentage %)
17-20 Years	5 (25%)
21-30 Years	5 (25%)
31-40 Years	7 (35%)
41-50 Years	3 (15%)
Total	20 (100%)



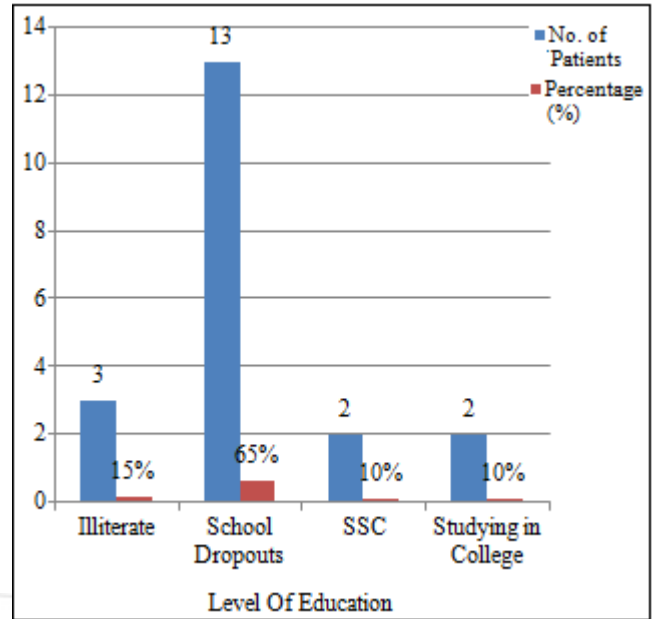
**Table 2: Sex Wise Distribution of Patients**

Sex of the Patient	Number of Patients (Percentage%)
Male	20 (100%)
Female	0 (0%)
Total	20 (100%)



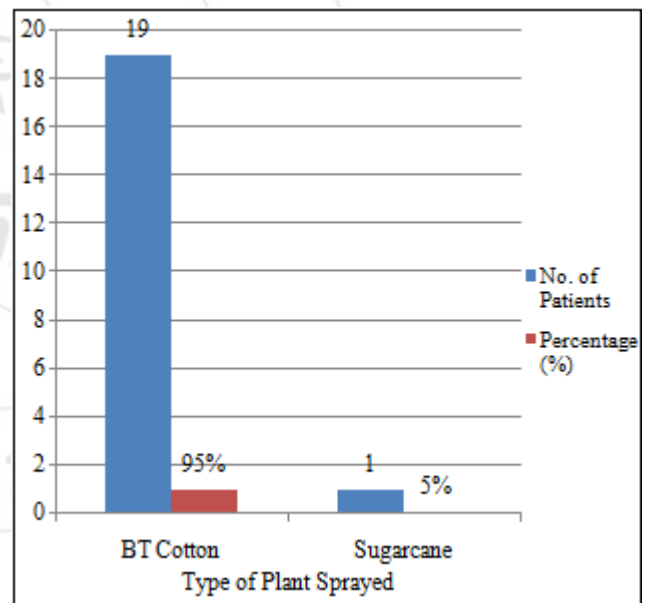
**Table 3: Education level of the Patients:**

Level of Education	Number of Patients (Percentage%)
Illiterate	3 (15%)
School Dropouts	13 (65%)
SSC	2 (10%)
Studying in college	2 (10%)
Total	20 (100%)



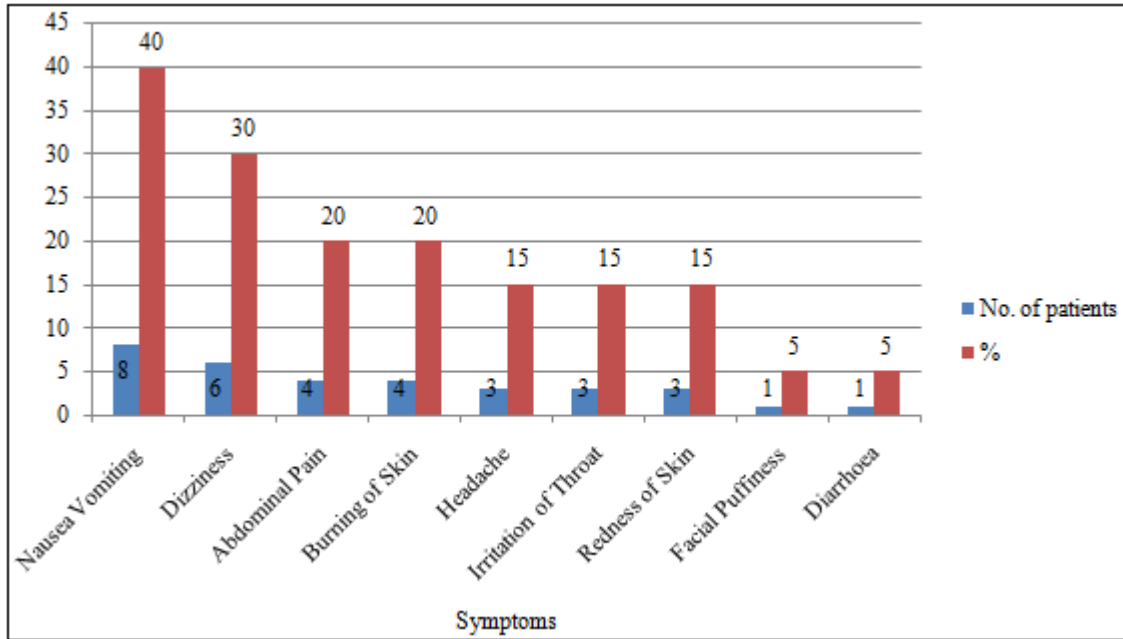
**Table 4: Distribution according to the type of Plants sprayed**

Type of Plant Sprayed	Number of Patients (Percentage%)
BT Cotton	19 (95%)
Sugarcane	1 (5%)
Total	20 (100%)



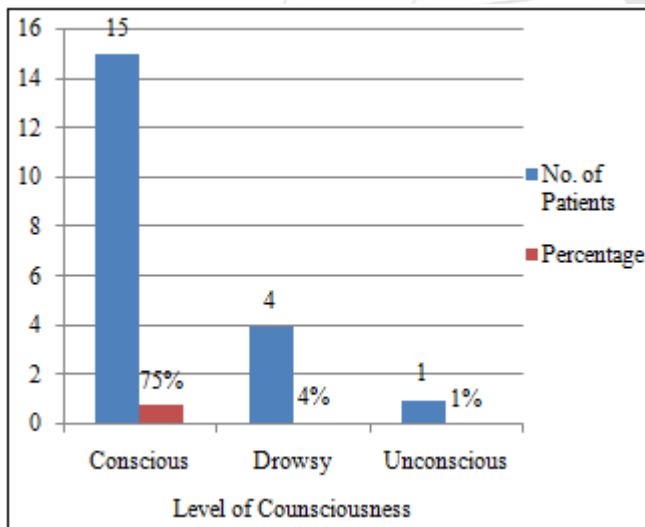
**Table 5: Symptoms wise distribution:**

Sr.no	Symptoms	No. of Patients (%)
1	Nausea Vomiting	8 (40%)
2	Dizziness	6 (30%)
3	Abdominal pain	4 (20%)
4	Burning of skin	4 (20%)
5	Headache	3 (15%)
6	Irritation of throat	3 (15%)
7	Redness of skin	3 (15%)
8	Facial puffiness	1 (5%)
9	Diarrhoea	1 (5%)



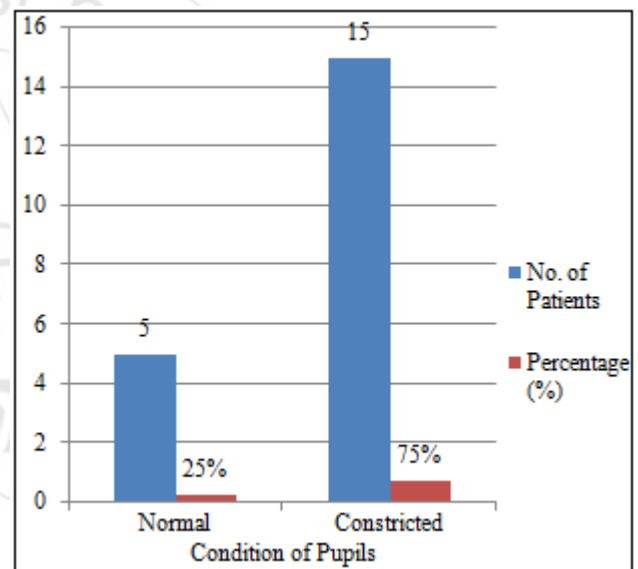
**Table 6:** Level of Consciousness

Level of Consciousness	No. of Patients (Percentage%)
Conscious	15 (75%)
Drowsy	4 (20%)
Unconscious	1 (5%)
Total	20 (100%)



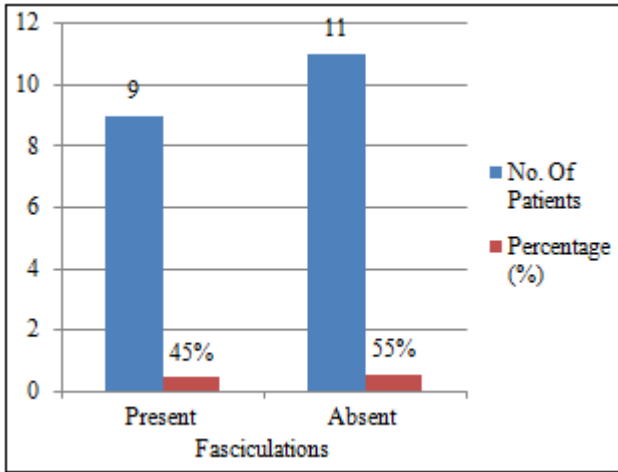
**Table 7:** Distribution of patients according to the condition of pupils at the time of presentation

Condition of pupils	Number of Patients (Percentage%)
Normal	5 (25%)
Constricted	15 (75%)
Total	20 (100%)



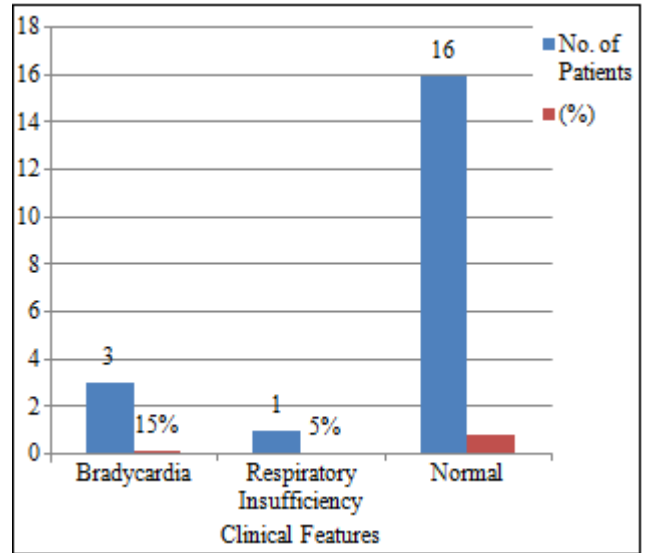
**Table 8:** Distribution of patients according to the presence of fasciculations

Fasciculations	No. of Patients (Percentage%)
Present	9 (45%)
Absent	11 (55%)
Total	20 (100%)



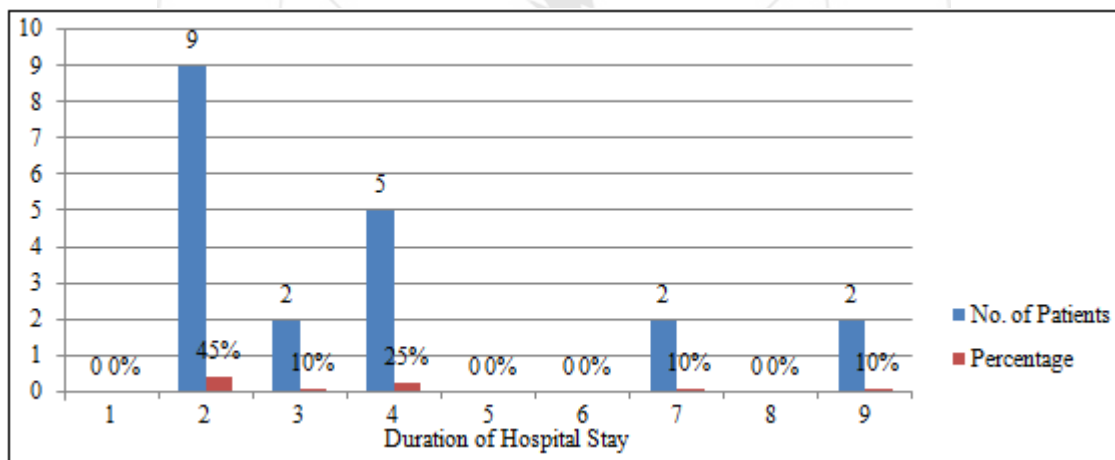
**Table 9:** Distribution of patients according to Clinical Features -

Clinical Features	Number of Patients (Percentage%)
Bradycardia	3 (15%)
Respiratory Insufficiency	1 (5%)
Normal	16 (80%)
Total	20 (100%)



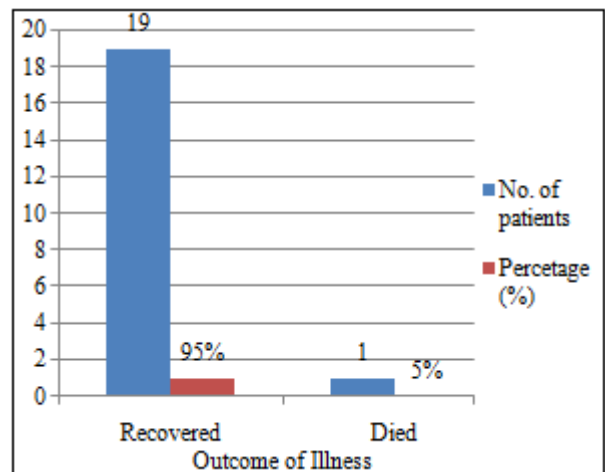
**Table 10:** Distribution of patients according to the duration of hospital stay-

No. of Days in Hospital	No. of Patients (Percentage)
1	0 (0%)
2	9 (45%)
3	2 (10%)
4	5 (25%)
5	0 (0%)
6	0 (0%)
7	2 (10%)
8	0 (0%)
9	2 (10%)



**Table 11:** Distribution of Patients according to the outcome

Outcome	No. of Patients (Percentage%)
Recovered	19 (95%)
Died	1 (5%)
Total	20 (100%)



### 3. Discussion

Pesticide drift is the airborne movement of pesticides from an area of application to any unintended site. It can happen if droplets or dry dust move away from the target (particle drift) or if chemicals are converted to vapor (vapor drift). A drift can harm the person who is spraying (operator) or can have more distant effects... when planes or tractors are used for spraying, the drift can travel many kilometers [3].

The pesticide may be inhaled by the person(s) who come in the range of the drift or may be inhaled by the exposed skin or mucous membranes (conjunctiva, mouth, nose). The drift may cause contamination of grains and food articles, soil, water and also leads to a lot of wastage of the pesticide. Environmental factors like temperature, humidity and most importantly, winds, play an important role in causing a drift. Faulty equipment and careless use play an important role at individual levels [4].

In developing countries, farmers face an increased risk because they may be still using toxic chemicals that may be banned by or restricted by other developed countries, application techniques may be faulty, inappropriate equipment or that which is poorly maintained may be used or legislation for safe use, though it exists, may not be implemented. Air temperature and humidity affect the volatility of some products, perspiration rate and use of personal protective clothes, shoes, gloves, masks etc. Wind obviously increases pesticide drift. If the operator is spraying against the wind, chances of drift towards his body are more.

If the plants are naturally short or younger, the drift may not hit his face. But if they are tall, as can happen with sugarcane or BT cotton, the drift may produce toxic effects due to the exposure of the face. LD50 by the oral route is less than that absorbed through the skin and pesticides enter the bloodstream more easily by the oral route than dermal, but toxicity depends on the pesticide and its dose [3].

Severity of toxicity due to pesticide spraying depends upon:-

1. Pesticide Toxicity-  
WHO CLASS 1A- Extremely hazardous.  
WHO CLASS 1B- Highly hazardous.  
WHO CLASS 2- Moderately hazardous.  
WHO CLASS 3- Slightly hazardous.  
WHO CLASS U- Unlikely to present acute hazard [6].
2. Exposure Time- the more the exposure time greater will be the risk.
3. Volume of spraying solution in litres- higher the volume higher the risk.
4. Operation- activity performed during working session- what the patient was doing while he got exposed to the toxin.
5. Profession- employed/own field- employed individuals remain in contact with the poison for more time than the owners of the field.

This study reviews the clinical features and outcome of 20 cases of accidental poisoning while spraying crops with organophosphate compounds:

The youngest patient was 17 years old, oldest (2) were 50 years of age (of whom 1 died). Average age-29.8 years. Maximum patients (85%) were in the age group 17-40. All the 20 cases were males, because in this region of Marathwada, spraying of insecticides is almost exclusively done by males. None of the educated individuals had agricultural education. 16 were working in their own farm, 4 were employed by other farm owners. All the patients developed toxic effects while spraying plants that were almost as tall as they were.

95% of the crops were of cotton (BT cotton), that grow tall. In 2016, the rainfall was particularly abundant and the growth of crops was more exuberant. In all the cases, the crops were minimally of the height of their chins. Average height of victims... 5'6" (165cm), least 5'3", Maximum 6'2". Estimated height of crop (approximate, from history, patients or relatives showed approximate height of plant in relation to the patient's face). In 12 cases, the crops were about 6 to 8 inches above the patient's head, in 8 cases, they were at face level.

In majority of cases, spraying was carried out just before or after rains. All said that there was a breeze, though not strong winds. They said that they avoided spraying if there was a strong wind because the spray does not go in the right direction. 2 positively accepted that the breeze was in the opposite direction.

The pumps used were strapped on the back or hand held, operated manually or with fuel like diesel or with chargeable batteries. Except for 2 persons who wore masks, no one had worn any protective equipment. Though their body was covered, their face and forearms, hands were exposed. Majority were not aware about protective gear or did not have it. They were very casual about it.

None of the patients had any prior associated co-morbid conditions. Amongst the symptoms with which the patients presented, nausea vomiting was the commonest one occurring in 8 (40%) patients while facial puffiness and diarrhea were least common.

Other features which occurred were dizziness (30%), abdominal pain (20%), burning of skin (20%), headache (15%), irritation of throat (15%) and redness of skin (15%). On examination 15 (75%) patients were conscious, 4 (20%) were drowsy and 1 (5%) was found to be unconscious. 15 (75%) patients had constricted pupils whereas 5 (25%) had normal sized pupils on presentation. Fasciculations were present among 9 (45%) patients; while the rest 11 (55%) had no fasciculations. 1 (5%) of them had respiratory insufficiency while 3 (15%) had bradycardia.

Among the 19 patients who survived 9 (45%) were admitted in the hospital for 2 days, 4 (20%) were admitted for 4 days while 2 (10%) were admitted for 3 days, 7 days and 9 days each. The 1 (5%) who died was in the hospital for 4 days. 3 patients had required ventilator support out of which 2 (10%) survived and 1 (5%) died.

#### 4. Summary and Conclusions

Drift of pesticides while spraying is common and can lead to serious consequences, even death.

Precautions to be taken while spraying:

- 1) Be careful while preparing the solution and filling the pump. Check the nozzle beforehand. Larger size of droplets may make them drift less as they settle down more easily.
- 2) Wear proper protective gear like mask, cap, gloves. Clean polythene bags may be used to cover the scalp and hands. Use a handkerchief or towel, or a clean cloth to cover the mouth and nose and use sunglasses to cover the eyes.
- 3) Avoid hot sunny days, strong windy or foggy weather and just before or after rains.
- 4) Do not spray against the wind.
- 5) Keep the wand or hose of the pump close to the target.
- 6) See that people around are aware that pesticides are being sprayed.
- 7) Learn the proper technique before you start spraying and see that the equipment is appropriate and well-maintained.



**Pic 3:** Grown up plants (taller than the farmer)



**Pic. 1:** Preparation for spraying



**Pic.2:** Young cotton plants

Name: \_\_\_\_\_ Male/Female (sprayer?)  
 Address: \_\_\_\_\_ Spray session #: \_\_\_\_\_  
 Date/Month: \_\_\_\_\_ Crop sprayed: \_\_\_\_\_

Fill out form after each spray session. Mark signs and symptoms if any experienced during or up to 24 hours after spraying

Periods used:  
 # Sprays used = \_\_\_\_\_  
 Hours sprayed = \_\_\_\_\_  
 Other signs/symptoms: \_\_\_\_\_

Number of:  
 (1) Mild  
 (2) Moderate  
 (3) Severe

Spray Session Verdict Category:  
 (1) No signs/symptoms  
 (2) Mild (only 1/2 marked)  
 (3) Moderate (at least one (2) marked)  
 (4) Severe (at least one (3) marked)

**Pic 4:** Farmers 'Self-Surveillance of Pesticide poisoning: A 12-month pilot in northern Vietnam'. Murphy HH, Hoan NP

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